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Identifiers- Verbal Imitation

Three 4-year-old boys were subjects of an experiment involving reinforcement of verbal imitation. Intended to provide insights into language learning and speech therapy, this investigation began by introducing to the subjects the idea of imitation of the experimenter's words. Each time the child correctly reproduced the stimulus word, he was given candy and praise. The next part of the study was similar in procedure except that Russian words were added but were never reinforced. In the third phase, subjects were not reinforced for imitating either English or Russian words. Later reinforcement of English word imitation was reinstated. The results, based on the number of correct imitations, showed that during experimental phases when reinforcement was tied to correct imitative responses, the correct imitation of English and Russian words increased, even though the Russian words were never reinforced. When reinforcement was not tied to correct imitation of the English words, correct imitation of both English and Russian words decreased. (WD)

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The University of Kansas Head Start Research and Evaluation Center

II B

"An Experimental Analysis of Verbal Imitation in Preschool Children"

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An Experimental Analysis of Verbal Imitation in Preschool Children[1]

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ABSTRACT

Running Head: Verbal imitatinn in preschool children

Three preschool children were reinforced for imitating English words presented by a model. The model also presented novel Russian words to the subjects but never reinforced the subjects imitation of these words. When subjects were reinforced for imitating the English words, their accuracy of imitating non-reinforced Russian words increased. When reinforcement was not contingent upon subjects' imitation of English words, accuracy of imitating both the English and the Russian words decreased. These results support and extend previous [illegible] on imitative responses.

An Experimental Analysis of Verbal Imitation in Preschool Children

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Imitation as a class of behaviors has become increasingly important both as a potential method of producing socially significant behavioral changes (Metz 1965; Lovaas, Berberich, Perloff and Schaeffer 1966; Baer, Peterson, and Sherman 1967) and as key concept in theoretical analyses of language development and socialization (Lovaas et al 1966; Bandura and Walters 1964). Recent experimental studies of imitation have produced two consistent findings: If a class of imitative responses is developed in a child, then relatively novel responses can be produced as a result of a demonstration without direct shaping of that response; if some imitative responses directly produce reinforcement, then other imitative responses may be maintatned even though they never directly produce reinforcement (Baer and Sherman 1964; Metz 1965; Lovaas et al 1966; Baer et al 1967).

Lovaas, Berberich, Perloff, and Schaeffer (1966) reported another related finding in the area of verbal imitation beyond that reported in other recent studies of imitation. Their subjects were two autistic children who were taught imitative speech through a long process of imitative training. As an extention of this investigation, they presented the subjects with Norwegian words in addition to the English words to imitate. When these subjects were reinforced for imitating English words, they also attempted to mimic the novel Norwegian words and improved in accuracy of imitation of these words even though there were no programmed consequences for either attempt to mimic or improved accuracy of the Norwegian words.

Since the findings of the Lovaas et al study (1966) have important implications both for theories of language learning and methods of speech therapy, one purpose of this investigation was to replicate the Lovaas et al (1966) experiment with normal children who had not been experimentally exposed to extensive imitative training. A second purpose of this study was to extend the design to contribute additional information about the relationship between reinforcement of some imitative responses and the improvement of other unreinforced imitative responses.

METHOD

Subjects

The subjects were three, four-year old male children of normal mental and physical development. All three children attended a preschool run by the Department of Human Development of the University of Kansas.

Procedure

Training was conducted four days a week in the morning, Monday through Thursday. Each training session lasted approximately 20 minutes. The reinforcers for subject 1 were assorted candies such as M & Ms and after-

dinner mints. For subjects 2 and 3, assorted candies were used as rein-- forcers in three of the four weekly sessions, and once a week the children were able to earn tokens as reinforcers which they could trade for a toy.

The first session of training consisted of a test to see if the subject imitated the experimenter's verbal cues. The subject was brought into the experimental room and seated at a low table across from the experimenter. The child was told that the experimenter would read a list of words one at a time and that the child could earn candy if he correctly repeated the word after the experimenter said it. The stimulus words for the first session were 115 English nouns of varying complexitysuch as apple, capital, reverse, cartoon, represent, and dog. Each word was presented twice in an unsystematic order. Each time the child correctly reproduced the stimulus word, he was immediately given a consumable reinforcer and also praised for his performance e.g.... If the child failed to correctly repeat the word, nothing was said and the experimenter presented the next stimulus word. The evaluation of whether the subject had correctly produced the English word was based on the experimenter's ability to understand the subject. If the subject's English word was clearly understandable to the experimenter, it was judged correct and reinforced. This allowed for a small amount of variance from an exact pronunciation. For example, a slight ellongation of the last vowel sound in "cartoon: was acceptable, while the substitution of a "g" for the "s" in "represent" was unacceptable. All sessions were tape recorded and the sessions with subject 1 were also recorded by an observer. All the subjects readily imitatid the experimenter's verbal models in the test session and were continued in the program.

Reinforcement for Imitation of English Words

The procedures in sessions two through six for subject 1 and two through five for subjects 2 and 3 were basically the same as those for the first session with two major exceptions. The instructions at the beginning of the sessions were deleted and the subjects were given no further instructions throughout the study. In addition, Russian stimulus words were added. The Russian words were presented in the same manner as the English words, however, the Russian words were never followed by either consumable or social reinforcement. The procedure involving the Russian words was as follows: A Russian word was presented, if the subject responded the experimenter presented a new stimulus word approximately 10 seconds after the subject's response; if the subject did now respond t . the Russian word, the next stimulus word was presented approximately 10 seconds after the experimental demonstration. The total number of English and Russian stimulus words was fifteen in sessions two through thirteen for all subjects, with each word being presented twice in a random order. Initially, subject 1 was given three Russian words to imitate, However, in session five, this was increased to five for the rest of the experiment. Subjects 2 and 3 were given four Russian words to imitate in sessions two and three. The number of Russian words presented was five in sessions four through thirteen and six for sessions 14 through 20. The Russian words presented to each subject are summarized session by session in Table 1.

Insert Table 1 here

Reinforcement of Behavior other than Imitation

A schedule of differential reinforcement of other behavior (DRO) for imitation of English words was used in sessions seven through ten an for subject 1, and sessions six through nine for subjects 2 and 3. During the DRO procedure, the subjects were never reinforced for imitating either the English or the Russian words, but were reinforced no sooner than five seconds after their last imitations. That is, the experimenter presented a word to a subject; if the subject imitated it, reinforcement was delivered no sooner than 5 seconds after the response. If the subject did not respond, reinforcement (e.g., candy and "food") was delivered no sooner than 5 seconds after the presentation of the stimulus word.

The DRO period after the subjects response was not measured consistently; the actual time varied between about 5 to 20 seconds with a mean of approximately 10 seconds. After the DRO interval elapsed and before the presentation of the next stimulus word occasionally additional social reinforcers were given to the subject on a non contingent basis.

In the third session of the DRO period for subject 1, a pair of new Russian words was added, replacing two of the old Russian words. A single new Russian word was introduced into the third session of DRO for subjects 2 and 3. The Russian stimulus words added during the DRO are labeled $Russian_2$, and the Russian stimulus words introduced during the initial procedures are labeled $Russian_1$. Since the number of Russian words presented in any one session was held constant, the introduction of the $Russian_2$ words necessitated a reduction in the number of $Russian_1$ words. In order to avoid any biassing of the sample of $Russian_1$ words, all of them were continued as stimuli, and those to be used in any one session were selected on a random basis. This method was used to select the $Russian_1$ words for the remainder of the experiment.

Reinforcement for Imitation of English Words II

After four sessions of the DRO schedule, direct reinforcementof the subject's imitation of English words was reinstated. Again only the imitation of the English words was reinforced, the imitation of the Russian words was never followed by either consumable or social reinforcers.

Pairing of English Words and Reinforcement

Subjects 2 and 3 were run on two additional procedures. One involved the pairing of the English stimulus words and reinforcement, similar to a classical conditioning paradigm. In the stimulus pairing procedure, the experimenter presented the English stimulus word and at the same time delivered a consumable reinforcer to subject. Whether the subject responded correctly, incorrectly, or not at all, the experimenter waited approximately 20 seconds and then presented the next stimulus word. Only the English words were paired with reinforcement; the Russian words were never paired with reinforcement. During the 20 second interval after the consumable reinforcer was delivered and before the next stimulus presentation accasional social reinforcers were given to the subject on a non-contingent basis. Two new Russian words were added during this procedure and were labeled $Russian_3$. The $Russian_2$ words were continued and the $Russian_1$ words presented in any session were selected on a random basis.

Reinforcement for Imitation of English Words III

Contingent reinforcement of correct imitation of the English stimulus words was reinstated. As in the two reinforcement procedures before, the subjects' responses to the Russian words were never followed by either consumable or social reinforcers.

Scoring of Verbal Responses

The data from all of the sessions were tape recorded, with the Russian words analyzed and scored later. The English words were not rescored and the scores presented in the results section are based on the number of English words correctly pronounced divided by the total number presented. Correctness was determined by the method outlined in the preliminary procedure. The scoring of the Russian words was done by two analysts working independently. One analyst scored all of the sessions, the second analyst scored half of the sessions. The sessions scored for analyst reliability were selected at random and represented points where the subjects' imitation was accurate and points where it was inaccurate. The scoring of the Russian words was carried out in a manner similar to that used by Lovaas et al (1966). Each letter pronounced correctly was given one point and each syllable pronounced correctly was given three points; the points were then totaled and divided by the total number of points possible to give a degree of correctness score. In addition, another measure of analyst reliability (right-wrong agreement) was computed/ the analyst's judgements of whether the Russian pronunciation was correct or incorrect were compared. When the two analysts agreed that a word was either correct or incorrect, it was scored as one point; if they disagreed, it was scored as zero. The total was then divided by the total number of agreements possible to give a right-wrong agreement score for that session. Table 2 contains a list of all the Russian stimulus words used in the experiment, the Russian spelling of each word, the phonetic spelling, and the points assigned to each word.

Insert Table 2 here

RESULTS

The results for the two measures of analyst realiability, right-wrong agreement and degrees of correctness agreement, were consistently high with the mean scores ranging from .90 to .95. The session by session scores for each subject are presented in Table 3. The high scores for analyst reliability over the entire experiment indicate that the changes in the subjects' imitation of the Russian stimulus words were clearly observable and objectively scoreable.

Insert Table 3 here

The overall results of the study are graphically presented in figures 1, 2, and 3, and the session by session scores for each individual Russian stimulus word is presented in Table 4.

Insert Table 4 and Figures 1, 2, and 3 here

While the graphs present a fairly clear picture of the changes in performance over experimental conditions, several points regarding the

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consistency and nature of the results need explicit statement.

The performances of the subjects over the experiment were very similar. All subjects steadily improved in their pronunciation of the Russian stimulus words during the initial reinforcement period. While the subjects' imitation of English words were scored in a different manner, there was a parallel improvement in their pronunciation of English words.

When the DRO schedule was introduced, there was an immediate decrement in the performances of all subjects on the Russian words. The initial drop was to a point approximately equal to the subjects' scores for imitation of Russian words at the beginning of the first reinforcement period. In the third session of the DRO period, two new Russian words were presented to subject 1 and a single new Russian word was presented to subjects 2 and 3. The scores for the $Russian_2$ words were below the initial scores for $Russian_1$ imitation during the first reinforcement period and also below the scores for the $Russian_1$ words during the third session of the DRO. The English imitation scores for subjects 1 and 3 again closely parallelled their scores for Russian imitation.

When the reinforcement of the imitation of English words was reinstated, there was an immediate improvement in the subjects' imitation of both the English and Russian stinulus words. All subjects again reached a high level of performance on the English and $Russian_1$ words with the scores on the $Russian_2$ words remaining slightly lower.

In the first session of the stimulus pairing the subjects imitation of the $Russian_3$ words added during this session was very accurate and the imitation of the $Russian_1$ words dropped only slightly. However, as the procedure was continued their performances on all Russian words again dropped to a level lower than the preceeding reinforcement period. The imitation of the English stimulus words followed a similar course eventually deteriorating to the lowest level of the entire experiment in the last session of the stimulus pairing procedure.

The second reinstatement of the reinforcement of imitation of English words again resulted in an immediate and pronounced improvement in the subjects' pronunciation of all of the Russian stimulus words. The scores forRussian pronunciation during this prodedure were some of the highest of experiment. Once again, the improvement in the Russian imitation was closely associated with a paralled improvement in the imitation of the English words.

It is important to note that the changes in the scores for the accuracy of imitation from session to session and from procedure to procedure represent a change in the topography of the imitative responses and not a failure to make initative responses. Subjects 1 and 3 made a verbal imitative response after every Russian stimulus presentation throughout the experiment. Subject 2 failed to make an imitative response to the Russian stimulus words twice in session 15 and once in session 17. While these failures to respond were scored as zero for the presentation, if they were left out of the scoring it would not change the basic shape or direction of the curves. Some examples of the decrease in accuracy after very accurate imitation of the same stimulus words are the responses: "topot" for the stimulus word "slovar", "borsha" for "deborchka", and "keyliga" for "kaneega".

DISCUSSION

The results of this study replicate and extend the initial findings of Lovaas et al (1966) related to improvement in imitation of unreinforced stimulus words. The data from the first reinforcement of imitation of English stimulus words period show a steady improvement in the pronunciation of the Russian stimulus words. But possibly more important for the extension of the findings of Lovaas et al study (1966) to the problem of normal speech development is the fact that the subjects for this experiment were what might be labeled natural speakers. That is to say that the language behavior was the result of processes normally programmed by the environment , and not the result of extensive experimental procedures designed to teach the subjects speech. It is also the case that these subjects were of an age when their vocabulary is rapidly increasing in size and complexity. So the finding that these subjects already possessed extensive imitative skills as data from the imitation of the English stimulus words readily show (their first session scores being 75, 85, and 95 per cent correct respectively) suggests that these imitative skills may be very important in the process or processes of vocabulary elaboration. This possibility is further strengthened by the main findings of the experiment that the subjects improved in their imitation of the Russian words which were never reinforced by the experimenter, indicating that it was not necessary to differentially reinforce every imitative verbal response for it to improve in accuracy. Studies by Baer and Sherman (1964) and Baer, Peterson and Sherman (1967) have also demonstrated that it is possible to maintain imitative responses which were never reinforced as long as some of the subject's imitative responses were reinforced. These studies also found that if the contingent reinforcement of imitation was discontinued for all imitative responses and reinforcement was delivered contingent on the occurence of other responses (a DRO schedule) then the rate and accuracy of all imitative responses decreased. These findings were replicated for the area of verbal imitation in this study. During reinforcement for behavior other than imitation, a similar decrement in the accuracy of both the formerly reinforced and non-reinforced imitative responses was obtained. When the reinforcement of the imitation of the English stimulus words was reinstated, both the reinforced and non-reinforced imitative responses again increased in strength.

The stimulus pairing procedure also involved discontinuing contingent reinforcement of all imitative responses. The data from the last two sessions of this procedure shows a similar decrement in imitative responding. Since the amounts of both social and consumable reinforcers delivered to the subjects remained fairly constant over the experiment, it is probable that the difference in performances were the result of the way in which the reinforcers were delivered. When the experimental procedures and results are looked at together, it appears that, under conditions where some imitative responses are directly reinforced by the experimenter, all imitative responses are strong and increase in accuracy; under conditions where this direct reinforcement was discontinued, all imitative responses appeared weaker and decreased in accuracy.

There are several possible explanations of these results. A number of recent papers on imitation have suggested that the development of non-reinforced imitative behavior can be analysed as a result of the experi-

mentally developed reinforcing properties of behavior similar to a model (Lovaas et al 1966; Baer et al 1967). A corresponding account may be applied to findings of the present study. During the reinforcement of English imitation, the subject was reinforced when his vocal production matched that of the experimenter. Since vocal matching (similar auditory stimuli) preceeded and was discriminative for reinforcement, it may have become a conditioned reinforcer. If that is the case, improvement on the Russian words could have been the function of the differential amounts of conditioned reinforcement involved in closer approximations to a matching vocal response (thus producing more closely matched auditory stimuli). When the relationship between matching vocal productions and reinforcement was withdrawn in the DRO and stimulus pairing procedures, the conditioned reinforcing effects of matching auditory stimuli should decrease, accounting for the decreased accuracy of matching the reinforced Russian words found during these two procedures. However, since the auditory consequences to the subjects of their own vocalizations were not directly manipulated, it is not possible to state definitely that the findings of this study were a result of the indirect manipulation of the conditioned reinforcement value of similarity.

Alternatively, it is also clear from the overall results of this experiment that for these subjects both the imitation of English stimulus words and the imitation of Russian stimulus words belong to the same general response class which may be labelled verbal imitation. This interpretation is based on the fact that all of the experimental operations were carried out on only the imitation of the English stimulus words. The imitation of the Russian words was never directly manipulated. Yet the results show that the Russian imitation covaries with the English imitation and increases or decreases as a function of the operations performed on the English imitation. It seems possible, therefore, that the procedures used in this study functionally reinforced verbal imitation in general rather than imitation of specific words. The maintenance of unreinforced imitations may be accounted for simply as a result of a variable ratio reinforcement schedule for imitation in general and a failure on the subjects' part to discriminate between the English and the Russian stimulus words as being differentially related to reinforcement. This latter analysis accounts for the maintenance of unreinforced imitations, however, it does not clearily specify why Russian imitations improved in accuracy.

Since the procedures used in this experiment were not adequate to empericslly differentiate between the possible explanations of the data presented here, a definitive explaination must await further developments in the areas of conditioned reinforcement and imitation.

FOOTNOTES

1. The research reported herein was performed pursuant to a contract with the Office of Economic Opportunity, Executive Office of the President, Washington, D.C., 20506. The opinions expressed herein are those of the author and should not be construed as representing the opinion or policy of any agency of the United States Government.

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Table 1

Session by session summary of the Russian words presented to each subject

1. товарам
2. карандаш
3. молоко
4. книга
5. словарь
6. девочка
7. мальчик
8. стена

Subject 1
Session No. and number of Russian words presented

1. none	6. (1, 2, 3, 4, 5)	11. (1, 2, 5, 6, 7)
2. (1, 2, 3)	7. (1, 2, 3, 4, 5)	12. (1, 2, 4, 6, 7)
3. (1, 2, 3)	8. (1, 2, 3, 4, 5)	13. (1, 2, 4, 6, 7)
4. (1, 2, 4, 5)	9. (1, 2, 5, 6, 7)	
5. (1, 2, 3, 4, 5)	10. (1, 2, 5, 6, 7)	

Subjects 2 and 3
Session No. and numbers the Russian words presented

1. none	8. (1, 2, 3, 7, 6)	15. (2, 3, 4, 5, 6, 8)
2. (1, 2, 3, 7)	9. (1, 2, 3, 5, 6)	16. (2, 4, 5, 6, 7, 8)
3. (1, 2, 3, 7)	10. (1, 3, 5, 6, 7)	17. (2, 4, 5, 6, 7, 8)
4. (1, 2, 3, 5, 7)	11. (1, 2, 5, 6, 7)	18. (1, 2, 3, 4, 7, 8)
5. (1, 2, 3, 5, 7)	12. (1, 2, 3, 5, 6)	19. (1, 2, 3, 4, 5, 6)
6. (1, 2, 3, 5, 7)	13. (1, 2, 3, 5, 7)	20. (1, 2, 3, 4, 5, 6, 8)
7. (1, 2, 3, 5, 7)	14. (1, 2, 3, 4, 5)	

Table 2

1. товарищ	tah var ish	12 345 67 plus 9	16 points
2. карандаш	care an dash	123 45 678 plus 9	17 points
3. молоко	mal a koy	123 4 567 plus 9	16 points
4. книга	kuh nee guh	12 34 56 plus 9	15 points
5. словарь	slo var	123 456 plus 6	12 points
6. девочка	da borch ka	12 3456 78 plus 9	17 points
7. мальчик	mal chick	123 456 plus 6	12 points
8. стена	sten na	1234 56 plus 6	12 points

Russian spelling, approximate phonetic spelling and points for scoring

Table 3

RWA (Right - Wrong Agreement) is a measure of the percentage of agreement between the two analysts on whether the Russian pronunciation was totally correct or partially incorrect.

DCA (Degrees of Correctness Agreement) is a measure of the mean percentage of agreement between the two analysts for the degree of correctness measure.

Subject one

Sess.	RWA	DCA	Sess.	RWA	DCA	Sess.	RWA	DCA
2	1.00	.96	2	1.00	.96	2	.90	.95
4	.80	.87	3	1.00	.90	4	.90	.97
5	.90	.91	6	1.00	.92	6	.90	.97
8	1.00	.89	8	1.00	.90	9	1.00	.91
9	1.00	.91	9	.90	.84	10	.90	.84
12	.90	.87	11	.80	.94	12	.90	.96
13	1.00	.96	12	1.00	1.00	15	.92	.94
			13	1.00	1.00	16	.84	.90
			15	1.00	.94	18	.92	.98
			16	.84	.90	20	.86	.94
			18	1.00	1.00			
			19	.92	.98			
Total	6.60	6.37		11.46	11.28		9.04	9.36
Mean	.94	.91		.95	.94		.90	.936

Session by session scores for each Russian word

Subject 1

Procedure	Reinforcement							DRO			Reinforcement		
Session No.	1	2	3	4	5	6	7	8	9	10	11	12	13
English words	.75	.80	1.00	1.80	1.00	1.00	1.00	.78	.50	.75	.80	.85	.88
(1)		.63	.87	1.00	1.00	1.00	.72	1.00	.75		1.00	1.00	1.00
(2)		.53	.76	.76	1.00	.88	.61	.76	.61		1.00	1.00	1.00
(3)		1.00	1.00		1.00	1.00	.89						
(4)				.88	1.00	1.00	1.00	.70		.73		1.00	1.00
(5)				.65	.80	1.00	1.00	.85	.66	.63	1.00		
(6)									.45	.50	.63	.57	.77
(7)									.50	.50	.83	.50	1.00

Subject 2

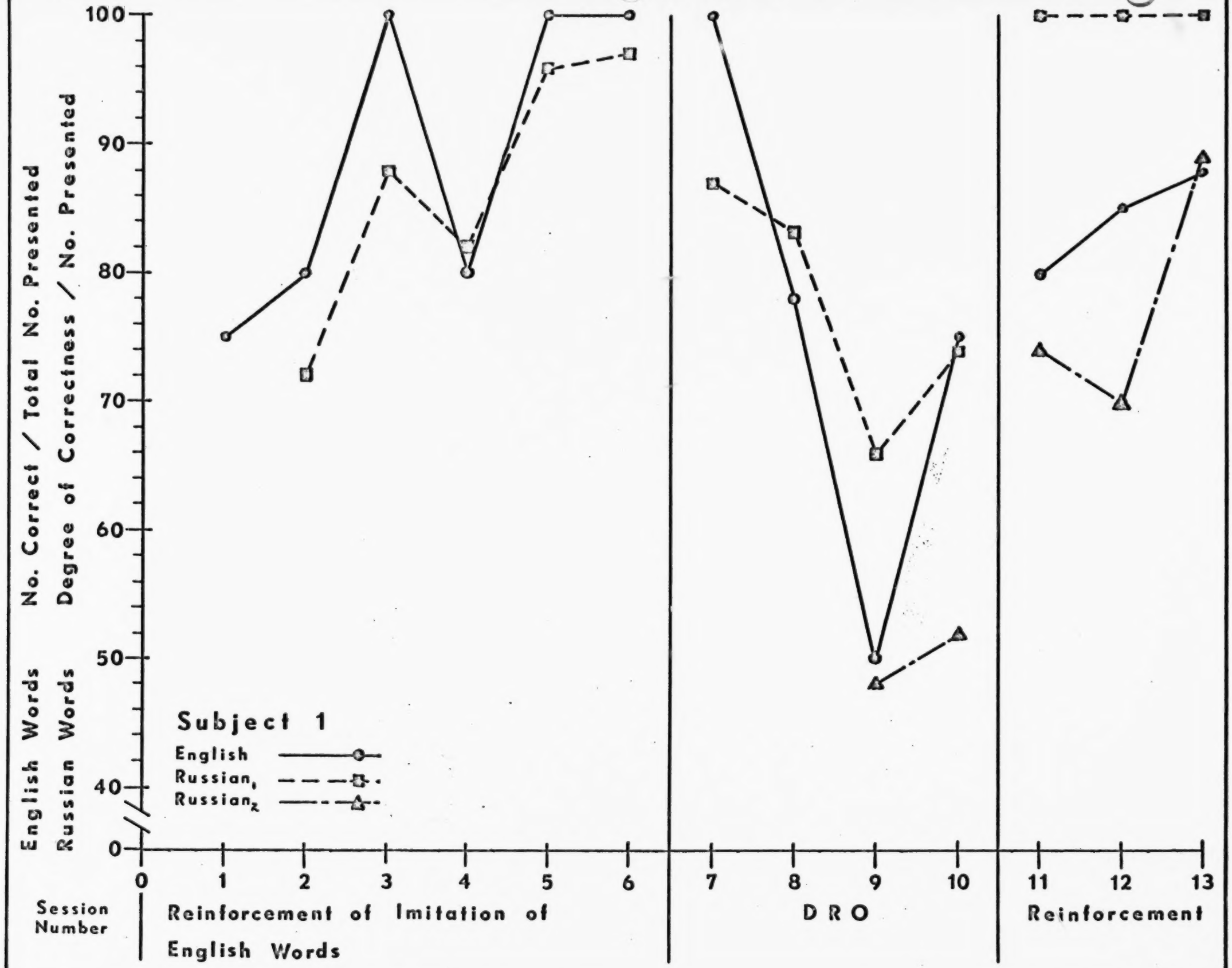
English words	.85	.90	.88	.80	.95	.80	.55	.55	.50	.90	.90	.95	.90
(1)		.65	.75	1.00	1.00	.66	.88	.78	.63	1.00	1.00	1.00	1.00
(2)		.76	.91	1.00	1.00	1.00	.88	.76	.71		1.00	1.00	1.00
(3)		.83	1.00	1.00	.87	1.00	1.00	.72	.90	1.00		1.00	1.00
(7)		.62	.66	1.00	1.00	.66	.66	.66		.71	1.00		1.00
(5)				.72	1.00	.54	.71		.71	1.00	1.00	1.00	1.00
(6)								.30	.18	.67	.76	.76	

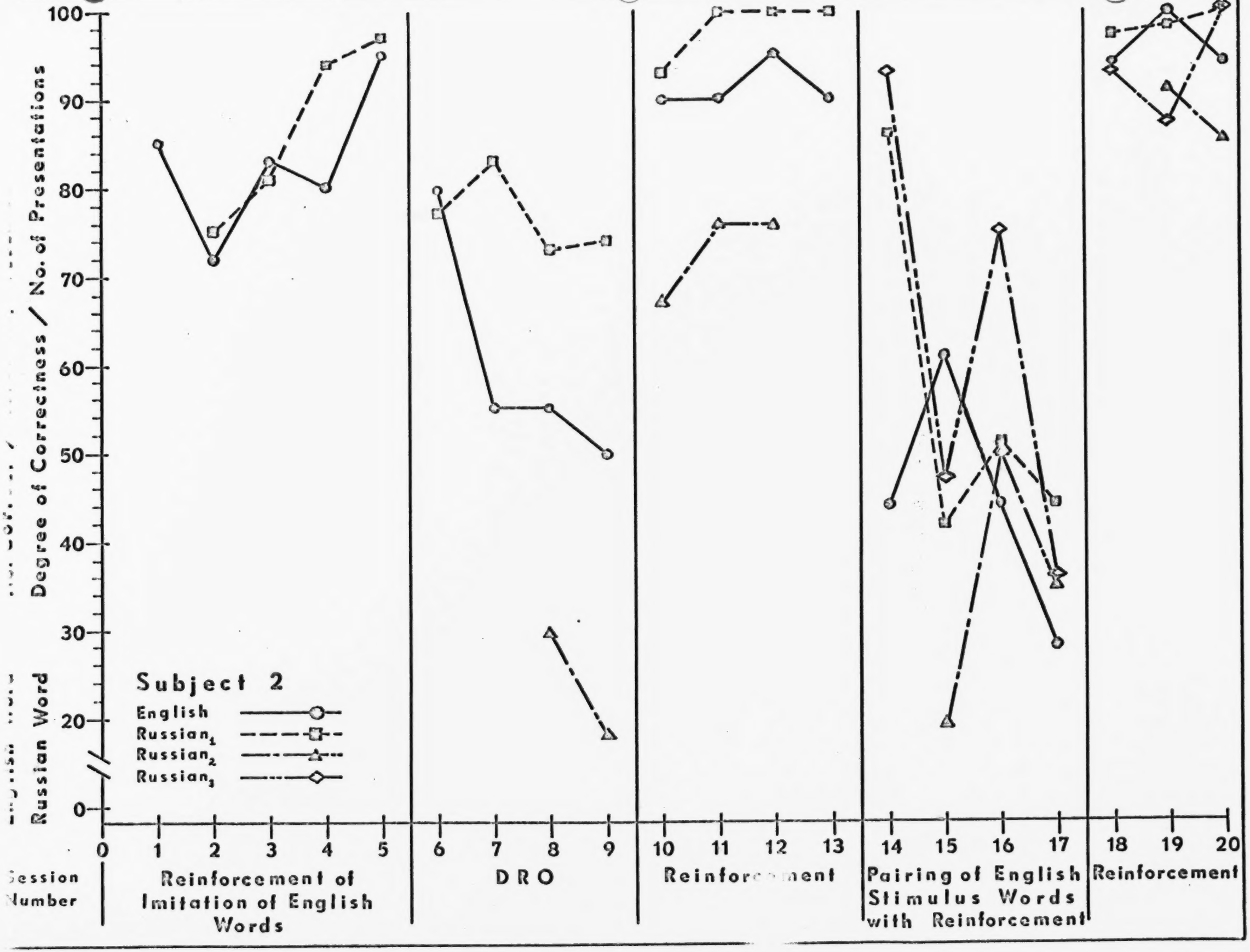
Subject 3

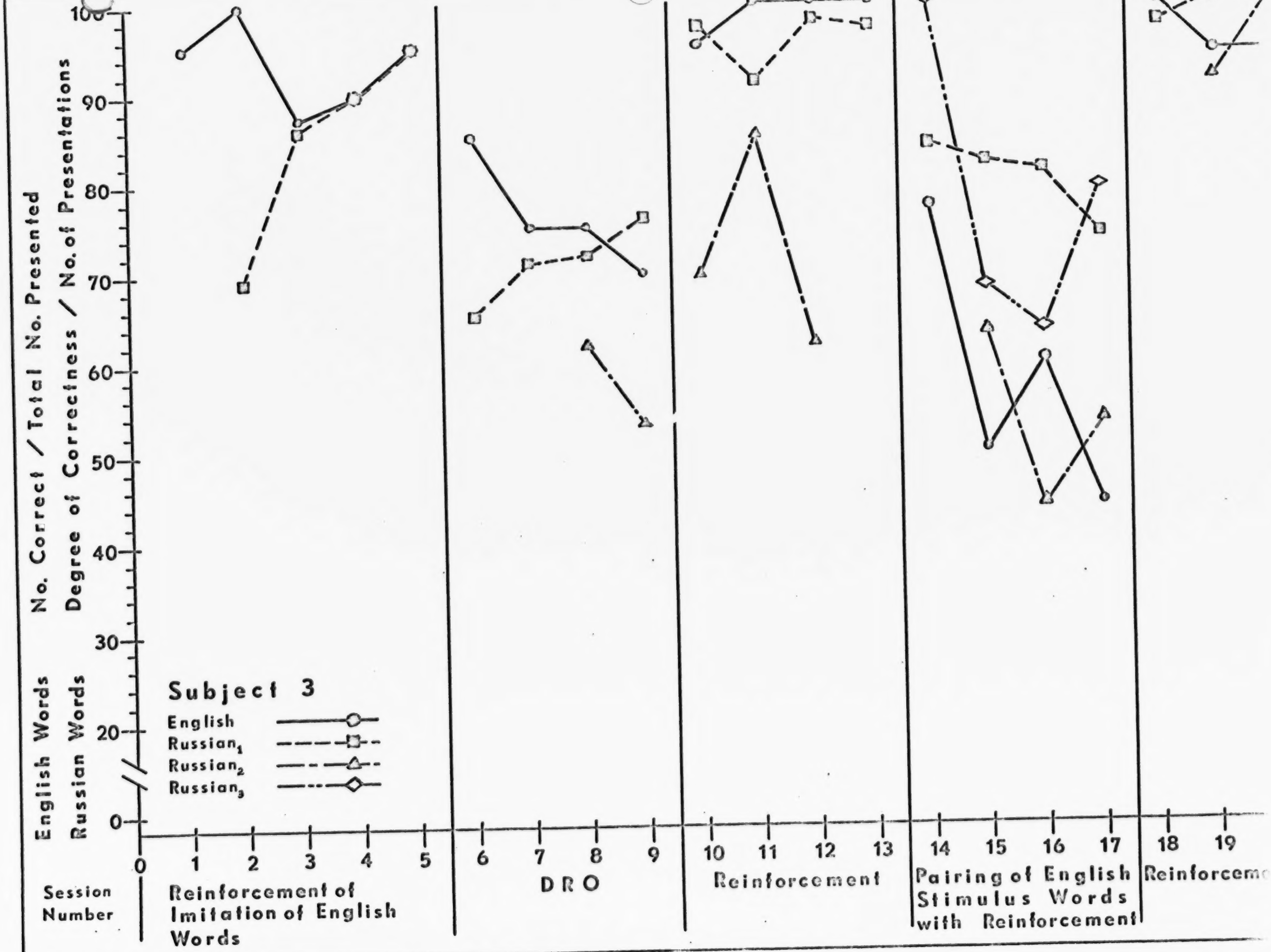
English words	.95	1.00	.87	.90	.95	.85	.75	.75	.70	.95	1.00	1.00	1.00
(1)		.75	1.00	1.00	1.00	.63	.72	.75	.75	1.00	1.00	1.00	1.00
(2)		.76	.73	.76	.76	.53	.58	.50	.53		.76	.91	1.00
(3)		.62	1.00	1.00	1.00	.50	.50	.92	.50	1.00		1.00	1.00
(7)		.65	.85	1.00	1.00	.75	.79	.88		.88	.88		.88
(5)		.		.83	1.00	.87	1.00		.75	1.00	1.00	1.00	1.00
(6)								.62	.53	.70	.85	.62	

Subject 2

Procedure	Pairing				Reinforcement			Pairing				Reinforcement		
Session No.	14	15	16	17	18	19	20	14	15	16	17	18	19	20
English words		.61	.44	.28	.94	1.00	.94	.77	.50	.60	.44	1.00	.94	.94
(1)	.84	..			1.00	1.00	1.00	.75				1.00	1.00	1.00
(2)	.87	.62	.68	.50	1.00	1.00	1.00	.88	1.00	.67	.76	1.00	1.00	1.00
(3)	1.00	.50			1.00	1.90	1.00	.75	.75			1.00	1.00	1.00
(7)		.76	.50	.50	.88				.71	.75	.75	.88		
(5)	.83		.39	.33		1.00	1.00	1.00		1.00	.87		1.00	1.00
(6)		.19	.50	.35		.91	.85		.63	.44	.53		.91	1.00
(4)	.93	.77	.87	.47	.87	.87	1.00	1.00	.73	.60	.87	1.00	1.00	1.00
(8)		.16	.62	.25	1.00		1.00		.62	.66	.70	1.00	1.00	1.00


100
90
80
70
60
50
40
0
English Words No. Correct / Total No. Presented
Russian Words Degree of Correctness / No. Presented
Subject 1
English
Russian1
Russian2
0
1
2
3
4
5
6
7
8
9
10
11
12
13
Session Number
Reinforcement of Imitation of English Words
DRO
Reinforcement


Degree of Correctness / No. of Presentations
Russian Word
100
90
80
70
60
50
40
30
20
0
Subject 2
English
Russian1
Russian2
Russian3
0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20
Session Number
Reinforcement of Imitation of English Words
DRO
Reinforcement
Pairing of English Stimulus Words with Reinforcement
Reinforcement


No. Correct / Total No. Presented
Degree of Correctness / No. of Presentations
English Words
Russian Words
100
90
80
70
60
50
40
30
20
0
Subject 3
English
Russian1
Russian2
Russian3
0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19
Session Number
Reinforcement of Imitation of English Words
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Reinforcement
Pairing of English Stimulus Words with Reinforcement
Reinforcem